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Kibble-Zurek Mechanism in Microscopic Acoustic Cracking Noises HAMED O. GHAFFARI, University of Toronto, PHILIP BENSON, University of Portsmouth, K. XIA, R. PAUL YOUNG, University of Toronto — The fast evolution of microstructure is key to understanding "crackling" phenomena. It has been proposed that formation of a nonlinear zone around a moving crack tip controls the crack tip velocity. Progress in understanding the physics of this critical region has been limited by our lack of hard data describing the detailed physical processes that occur within. For the first time, we show that the signature of the non-linear elastic zone around a microscopic dynamic crack maps directly to generic phases of acoustic noises, supporting the formation of a strongly weak zone near the moving crack tips. We additionally show that the rate of traversing to non-linear zone controls the rate of weakening, i.e. speed of global rupture propagation. We measure the power-law dependence of nonlinear zone size on the traversing rate, and show that our observations are in agreement with the Kibble-Zurek mechanism (KZM). In addition, we illustrate that cracks exhibiting global rupture fronts with velocity faster than Rayleigh waves (i.e., super-shear rupture fronts) display a complex configuration of non-linear zone prior to the fast weakening phase.

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